14.04.00

(substitution sheet)

Set of Amended CLAIMS

1. A method of obtaining quality indicators for an objective assessment of a degraded or output video signal with respect to a reference or input video signal by quantifying the strength of edges or signal transitions in both the input and the output video signals using edge or signal transition detection, said method comprising:

a first main step of generating image features of the input and output video signals, the image features including edge information , and

a second main step of determining quality indicators from the generated image features,

characterised in that

the first main step includes the steps of:

a) detecting edges in the input and the output video signals, respectively (25, 27), and

b) calculating the edginess of the input and the output video signals, providing input and output edge signals (26, 28); and

the second main step includes the steps of:

c) establishing introduced edges in the output edge signal by comparing the input and output edge signals of corresponding parts of the input and output video signals (29), introduced edges being edges which are present in the output edge signal and are absent at corresponding positions in the input edge signal;

d) establishing omitted edges in the output edge signal by comparing the input and output edge signals of corresponding parts of the input and output video signals (33), omitted edges being edges which are present in the input edge signal and are absent at corresponding positions in the output edge signal;

e) obtaining normalised values of the introduced edges relative to the output edge signal adjusted by a first normalisation factor (30);

f) obtaining normalised values of the omitted edges relative to the input edge signal adjusted by a second normalisation factor (34);

g) calculating a first quality indicator by averaging the values obtained in step e) (31, 32); and

From the introduced edges, in combination with a first normalization factor applied at input terminal 47 of averaging means 49, a first quality indicator 51 is calculated. A second quality indicator 52 is calculated by averaging means 50 from the omitted edge signal in accordance with a second normalization factor applied at an input terminal 48 of the averaging means 50.

Those skilled in the art will appreciate that the edge detection and calculation means 42, 43 can be combined into single edge operator means, while using appropriate multiplexing techniques. This is also valid for the detection means 45 and 46, as well as the averaging means 49 and 50. Preferably, the circuit presented can be implemented in an Application Specific Integrated Circuit (ASIC) or suitable programmed processor means.

The arrangement can be used for measuring the quality of video transmissions as well as for measuring the quality of video codecs or any other video processing systems.

While the present invention has been described with respect to a particular embodiment, those skilled in the art will recognize that the present invention is not limited to the embodiments described and illustrated herein. Different embodiments and adaptions beside those shown and discussed as well as many variations, modifications and equivalent arrangements will now be reasonable suggested by the foregoing specification and drawings without departing from the substance or scope of the invention. Accordingly, it is intended that the invention be limited only by the spirit and scope of the claims appendant hereto.

signals.

10. A method according to claim 9, characterised in that for the chrominance signals the constant part of the first and second normalisation factors is in a range between 5 and 15, preferably 10.

11. A method according to claim 8, 9 or 10, characterised in that of the first and second quality indicators of each the luminance and chrominance signals a weighted quality indicator is obtained, and a Mean Opinion Score (MOS) is calculated from the obtained weighted quality indicators.

12. A method according to claim 11, characterised in that multiple linear regression techniques are used for weighing of the respective first and second quality indicators.

13. A method according to any of the previous claims, characterised in that the normalisation factors and/or weighing of the quality indicators are set from quality indicators obtained from subjective quality data and calculated quality data.

14. An arrangement for obtaining quality indicators for an objective assessment of a degraded or output video signal with respect to a reference or input video signal by quantifying the strength of edges or signal transitions in both the input and the output video signals using edge or signal transition detection, said arrangement comprising:

means for generating image features of the input and output video signals, the image features including edge information, and

means for determining quality indicators from the generated image features,

characterised in that

the means for generating image features include:

a) means (42, 43) for detecting edges in the input and the output video signals, respectively, and

b) means (42, 43) for calculating the edginess of the input and the output video signals, providing input and output edge signals;

and the means for determining quality indicators include:

c) means (45) for establishing introduced edges in the output edge signal by comparing the input and output edge signals of corresponding parts of the input and output video signals, introduced edges being edges which are present in the output edge signal and are absent at corresponding positions in the input edge signal;

d) means (46) for establishing omitted edges in the output edge signal by

h) calculating a second quality indicator by averaging the values obtained in step f) (35, 36).

2. A method according to claim 1, characterised in that

i) the input and output edge signals are provided as corresponding unipolar signals;

j) the input and output edge signals of corresponding parts of the input and output video signals are aligned;

k) a bipolar distortion signal is established by difference building of the aligned input and output edge signals, and

l) the introduced and omitted edges are established from the respective polarities of the distortion signal.

3. A method according to claim 1 or claim 2, characterised in that the first and second normalisation factors are set in accordance with the characteristics of the video signals.

4. A method according to claim 3, characterised in that the first and second normalisation factors comprise a constant part set in accordance with luminance and chrominance values of the video signals.

5. A method according to claim 3 or 4, characterised in that the first normalisation factor comprises a variable part obtained from maximum characteristic edge values of the video signals.

6. A method according to any of the previous claims, characterised in that the input and output edge signals are provided from Sobel filtering.

7. A method according to claim 6, characterised in that the input and output edge signals are provided from improved or smeared Sobel filtering.

8. A method according to any of the previous claims, characterised in that the first and second quality indicators are obtained for either luminance and/or chrominance signals of the input and output video signals.

9. A method according to claim 8, dependent on claims 5 and 7, characterised in that for the luminance signals the constant part of the first normalisation factor is in a range between 15 and 30, preferably 20, the constant part of the second normalisation factor is in a range between 5 and 15, preferably 10, and the variable part of the first normalisation factor is in a range between 0.3 and 1, preferably 0.6, times the maximum value of the luminance signal of the input and output video

14.04.00

comparing the input and output edge signals of corresponding parts of the input and output video signals, omitted edges being edges which are present in the input edge signal and are absent at corresponding positions in the output edge signal;

e) means (47) for obtaining normalised values of the introduced edges relative to the output edge signal adjusted by a first normalisation factor;

f) means (48) for obtaining normalised values of the omitted edges relative to the input edge signal adjusted by a second normalisation factor;

g) means (49) for calculating a first quality indicator (51) by averaging the values obtained in step e); and

h) means (50) for calculating a second quality indicator (52) by averaging the values obtained in step f).

15. An arrangement according to claim 14, characterised in that the edge detection and calculation means comprise Sobel filter means.

16. An arrangement according to claim 14, characterised in that the edge detection and calculation means comprise improved or smeared Sobel filter means.

17. An arrangement according to claim 14, 15 or 16, implemented in digital processor means.

18. An Application Specific Integrated Circuit (ASIC) adapted to include means performing all the method steps of any of claims 1 to 13, or including the arrangement of any of claims 14-17.

19. Use of the method, arrangement or ASIC according to any of the previous claims, in measuring the quality of video codecs.

20. Use of the method, arrangement or ASIC according to any of the claims 1 to 18, in measuring the quality of video transmissions.